

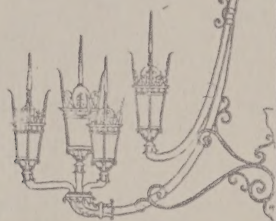
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Boston's New Economy: Institutions and Higher Education

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I. Boston's New Economy and Blue Chips Institutions¹

-John Avault and Mark R. Johnson

Boston's "New Economy" consists of industries and activities that have excellent growth prospects for both output and employment and that, furthermore, are already concentrated in the Boston area due to the unique advantages that Boston offers for their start-up and growth. Under these criteria we find two major clusters, both of which are well suited for and firmly established in the Boston area: 1) Health services and products, including biotechnology, medical instruments, and laboratory services, as well as hospitals, clinics, and related personal health service industries. 2) Information products and services such as computer hardware and software, non-physical research, management and consulting services.

Our last "new economy" featured computer and electronics products which are now standardized commodities that have moved to overseas production and low-cost labor markets. Today's new economy once again involves the application of new technologies to satisfy emerging and potentially huge world markets with products that are initially special and customized. In this emergent stage of product and technology cycle Boston's intellectual, academic, and entrepreneurial infrastructures contain the resources needed to claim a large share of new markets while these markets are in their most rewarding stages of growth.

Boston's Health Services and Medical Research Economies:

Health care occupies a unique position in the national and Boston economies. Private (non-government) health care services represent over 11 percent of this country's Gross National Product and about 6 percent of the nation's jobs. The steady growth of the health care economy is expected to continue well into the future, principally because of the aging of our population and national income expansion. U.S. employment in health services is projected to rise by an average 3.0 percent annually through the year 2000, much faster than the 1.2 percent benchmark for the overall economy.

¹ This paper and the one that follows (II. Profile of Boston's Higher Education Institutions) are from The Howell Report; Technical Appendix, Volume One, Boston Redevelopment Authority, November 8, 1990.

Advances in health care today are coming more and more from the discovery and application of new technologies. New diagnostic and treatment advances begin with the research programs of our nation's best minds in private industry and especially in our institutions of medicine and learning. Boston is a national and world leader in medical research. Institution based medical research in Boston involves nearly 8,100 jobs, nearly half of which are in the Longwood Medical Area. These institutions will expand their research activities to include 3,100 to 5,500 additional research and support personnel over the next decade. Industries that manufacture medical products are also projected to show exceptional growth, and medical products that embody the most advanced technologies will enjoy the most rapidly expanding markets.

The Boston economy specializes in health care, with 76,200 jobs making up over twelve percent of the city's total employment in 1989. Boston's health sector specializes in hospitals, which account for over eight percent of all Boston employment, about two and one-half times the national average. The exceptional size and strength of Boston's hospitals is due in large part to their diversification. In addition to tending to the health needs of the local population, they also export some of their services, both through the treatment of visiting patients and especially through their research programs. Massachusetts hospitals, led by Boston Teaching Hospitals, treated more than 50,000 out-of-state inpatients in 1987, according to the Massachusetts Health Data Consortium. This was about six percent of total inpatients and \$245 million in patient charges.

The city's great institutions -- hospitals, medical schools, universities, and institutes -- receive more grant funding from the National Institutes of Health (NIH) than do those of any other city in the nation, on a resident per capita basis. These NIH grant awards represent one out of every fourteen dollars awarded nationally. Nine of the country's top eleven NIH grant recipient hospitals are in the city of Boston. Corporate sponsorship of institution based research is on the rise also. Massachusetts General Hospital, for example, has research funding partnerships with major American, German, and Japanese firms.

The diversification that has occurred from a purely clinical treatment base to both treatment and research has enabled Boston's hospitals to attract renowned doctors and researchers, who have collectively brought in hundreds of millions in research dollars annually to the Boston economy. This research activity is experiencing exceptional growth, adding jobs and new facilities and expanding funding sources. Over the next decade the

medical research institutions will add an estimated 2.6 million square feet of research space and employ an estimated 3,100 to 5,500 new researchers and support staff. See Tables 1 and 2.

There are 25 Medical Research Institutions (MRIs) in Boston; seventeen are research hospitals, five are non-profit research institutes and three are medical schools. There is a total of 2.7 million square feet of research space housed in these institutions. The MRIs collectively have expressed a demand for 2.6 million square feet (s.f.) of new research space over the next several years. Hospitals and medical schools have submitted plans and proposals or made lease commitments for 2.4 million s.f. of additions. A further 254,000 s.f. of needed space was reported by hospitals and non-profit research institutes in the BRA's 1987 Medical Industry Study, but has not yet appeared in any project proposals from the institutions nor in lease commitments for privately developed space.

Geographically, the institutional research space is concentrated in three areas. The Longwood Medical Area contains about 1.3 million s.f., nearly half of the city's total. The Longwood institutions need an additional 1.3 million s.f. of research space, nearly half (48 percent) of the expected demand in the city. The West End-Charlestown Medical Area is the site of 784,000 s.f. of institutional research space, which is about 30 percent of Boston's current inventory. In the 1990s the West End-Charlestown institutions will need an additional 391,000 s.f., or 15 percent of total city demand. The South Station-Newmarket Medical Area wants to more than double its medical research space from its current 524,000 s.f. with an additional 861,000 s.f., which is one third of the total amount of the new institutional research space in demand. Boston hospitals located throughout Boston, and not part of the three above-named districts, have approximately three percent of existing research space, and propose to add 95,000 s.f. to their existing 75,000 s.f.

Demand for research space might be met outside an institution's campus, such as at the forthcoming Olmsted Plaza or South Station Technopolis; plans for institutional additions may change according to the availability of such space. In the 1989-2000 period private developers are prepared to offer Boston's medical institutions and commercial research, biotechnology, and pharmaceutical firms 1.7 million square feet of research space. Proposals include: 330,000 s.f. at the Charlestown Navy Yard's End; 578,000 at South Station; and 776,000 at Olmsted Plaza. In addition to medical research, these projects will provide another 405,600 square feet devoted to parking, daycare, retail, office and academic uses. The total

employment to be generated from this space is 4,654 full time equivalent construction jobs and 4,172 full time equivalent permanent jobs. These projects will contribute to the City of Boston linkage program with \$5.5 million supporting affordable housing and \$1.2 million for jobs training. These projects represent over \$400 million of investment in the Boston economy. **See Table 3.**

The future demand for institutional research space and employment is heavily dependent on the availability of funding for research projects. The two major sources of research funding for the medical research institutions are the federal government and corporate-sponsored research agreements. According to the BRA's Medical Industry Survey, in 1986 Boston's research hospitals received 63 percent of their funding from the federal government and 18 percent from private corporations.

The federal funding of research is disbursed by the National Institutes of Health (NIH) and the National Science Foundation (NSF). According to the most recent NIH Grants and Awards report, the United States funding for NIH projects rose from \$3.0 billion in FY1981 to \$4.7 billion in FY1988 in constant dollars, an annual rate of growth of 6.6 percent beyond inflation. Massachusetts' portion of NIH funding increased from about \$317 million in FY1981 to \$503 million in FY1988, which was an annual growth rate of 6.8 percent. The share of NIH money flowing into Massachusetts has increased from 10.5 percent of all U.S. NIH dollars in FY1981 to 10.6 percent in FY1988. The Boston portion of U.S. NIH funding escalated from \$227 million in FY1981 to an estimated \$352 million in FY1988 which was an annual rate of growth of 6.5 percent. Boston's share of total NIH funding is hovering around 7.5 percent of total U.S. funding, and it gets about 70 percent of the Massachusetts total. In essence, Massachusetts and Boston were receiving sizable portions of an expanding pie.

Boston's Emerging Growth Technology Industries:

A new generation of technical-based growth industries is emerging from the research institutions in the Boston metro core. The educational, medical and research institutions are now not only carrying out basic research in the biotechnical and medical fields but they are generating a number of spin-off private companies. The number and size of these new companies are expanding rapidly, although from a small current base. In addition to biomedical industries such as biotechnology therapeutics and diagnostics, medical instruments, and health services, the private sector industries of computer services, non-physical

research, and management business services are technology driven industries with exceptional growth prospects and a very high degree of concentration in the Boston metro area. The high degree of interdependence among these dynamic industries is important to the metropolitan area's future economy. Their individual successes create more business for one another, multiplying employment and business opportunities for the regional economy.

Table 4 shows the employment size, relative importance, and location quotients of several growth technology industries in Massachusetts and Metro Boston. The location quotient is a measure of specialization. It is calculated as the percent of total jobs that a given industry contributes to a local economy, divided by the corresponding national percent of all jobs found in that industry. A location quotient of 1.00 indicates that an area has the same employment concentration for an industry as the United States as a whole. A quotient higher than 1.00 indicates that an area specializes in that industry. Massachusetts' and metropolitan Boston's quotients are high in these growth industries.

Boston is at the center of the nation's commercial biomedical industries. Eighty-six percent of Massachusetts biotechnology industry employment was in the Boston metropolitan area in 1987, according to the U.S. Department of Commerce. Twenty percent of total U.S. sales in medical instruments are sold by New England manufacturers, and eighty percent of Massachusetts medical instruments employment is in the Boston area. These are among the industries with the strongest projected national growth in both production and employment, according to the U.S. Department of Labor.

Boston is well positioned to lead the nation in innovation and achievement in the medical services, research, and product fields and to lead the state into the next stages of economic growth. Health technologies are a major component of the new high tech, and Boston is at the forefront of this development. Discovery is taking place in both private company labs in industries such as biotechnology and in public and private non-profit institutions. The field is noted also for the alliances and partnerships between institutions and business.

The private Biotechnology drug industry is quite small, representing 0.03 percent (3 percent of one percent) of national employment in 1987, but it is also growing rapidly, with national employment having increased at a 9.5 percent annual rate between 1984 and 1987. Massachusetts does have a concentration of biotechnology firms and employment, a result of the comparative advantage provided by Boston's academic medical institutions. Within

Massachusetts, 86 percent of the state's biotechnology employment was in the Boston metropolitan area in 1987, according to the U.S. Dept. of Commerce.

Allied with the biotechnology drug industry is the medical instruments industry, which is presently nearly 10 times the size of Biotech manufacturing. Twenty percent of total U.S. sales in biomedical instruments (such as intensive care equipment and fetal monitors, and laboratory equipment) are sold by New England manufacturers. Massachusetts has double the national level of employment concentration in this industry, and 80 percent of the state's medical instruments employment is in the Boston metropolitan area.

Other private industry sectors delivering the most advanced new products and services to the fastest growing markets include both laboratory and non-physical research, management consulting and related business services, and computer software and services. Computer software and services is the strongest sector considered by a recent Bureau of Labor Statistics study, with 4.9 percent annual job gains projected through the year 2000. The Boston Metropolitan area has nearly three times the national average proportion of total jobs in this industry, and 93 percent of Massachusetts state employment in this industry is in the metro area.

The research and management consulting business services sectors have a projected annual rate of employment growth of 3.2 percent, two and one-half times the national economy average. The Boston Metropolitan area has 1 1/2 to 3 times the national average employment concentration in these industries, representing 89 to 95 percent of the Massachusetts employment in these industries.

The Metropolitan Boston computer industry is maturing. The slowdown in demand for certain computer products is part of a restructuring process occurring industry-wide and has caused a contraction in regional employment. The Metro area has been hit particularly hard because of its employment concentration in mini-computers. The prevailing view seems to be that the Massachusetts computer industry has fallen off a cliff. This is not the case.

Certainly, the days of ever rising employment and profits for our larger and older firms are over. Yet they are moving strenuously to reorganize and trim down, and are introducing new products already attracting new customers. The U.S. State Department's recent \$875 million purchase from Wang Laboratories was not for aging wordprocessors but for a computer and communications network just developed by Wang. Companies also are benefiting from new markets opening up overseas; GenRad Inc. of Concord recently received

permission from the U.S. Government to sell its semiconductor test equipment systems in Eastern Europe— where it sold about \$10 million worth the year prior to America's tightening of export barriers in 1980.

The real success stories in Boston's computer industry rarely make the headlines generated by the restructuring of large firms. The area has many smaller companies growing quickly in emerging areas such as Artificial Intelligence, Supercomputing and Robotics. Unquestionably, some of these are the DEC's and Lotus's of the 1990s. They will succeed because of Boston's competitive advantage of the combination of venture capital, specialized services, clusters of related firms, and highly qualified labor.

Metro Boston has 3 of "21 top computer companies to watch in the 1990s", according to The Wall Street Journal: Thinking Machines, American Superconductor and Kurzweil Applied Intelligence. It also has three of the U.S. top 20 fastest-growing companies started during the 1980s; in fact, the fastest growing startup in the nation last year was Appex, located in Waltham. Appex makes systems and provides services for the cellular communications industry. Other companies in the top 20 include Bachman Information Systems of Burlington, involved with computer aided software engineering, and Mercury Computer of Lowell, producing medical and aerospace imaging equipment. Massachusetts has the 2nd largest number of computer companies in the U.S. after California; 11 of the largest 100 software companies; and 7 of 40 computer companies on the INC. magazine 100 list of fastest growing publicly held companies in 1989.

Both the biotechnology and computer sectors illustrate that the Boston economy's strength is not tied to any particular product line. Its strength, rather, is to be found in the development stage of product and technology cycles. The human, business, and institutional resources that support the emergence of new technologies and their commercial growth are the vital base of Boston's new economy.

Table 1: Institutional Development Summary by Type of Construction and by Year of Completion, 1989-2000 and Beyond

YEAR OF COMPLETION	TOTAL SQ. FT.	MEDICAL RESEARCH SQ. FT.	MEDICAL CLINICAL SQ. FT.	OFFICE SQ. FT.	ACADEMIC SQ. FT.	PARKING SQ. FT.	HOUSING SQ. FT.	OTHER SQ. FT.	EMPLOYMENT		LINKAGE		TOTAL DEVELOPMENT COST (MILLIONS)
									CONSTRUCTION	PERMANENT	JOBS	HOUSING	
1989	487,384	487,384	0	0	0	0	0	0	1,323	984	\$300,000	\$1,500,000	\$135.6
1990	1,023,563	53,590	544,355	151,218	41,000	140,000	84,000	9,400	1,260	1,856	\$359,355	\$1,786,775	\$257.6
1991	424,219	242,459	20,000	54,760	87,000	0	0	20,000	739	930	\$62,800	\$314,000	\$117.1
1992	2,016,000	465,000	0	130,900	255,000	175,000	929,000	61,100	2,123	1,963	\$385,100	\$1,927,300	\$388.0
1993	976,610	135,060	430,250	114,020	0	0	0	297,280	1,238	1,551	\$620,680	\$3,103,400	\$256.5
1994	2,628,700	318,000	931,000	0	600,000	562,200	60,000	157,500	2,897	4,295	\$1,350,300	\$6,751,500	\$620.5
1995	792,500	118,000	0	0	73,000	350,000	161,500	90,000	548	450	\$281,000	\$1,405,000	\$75.5
1996	701,000	40,000	92,000	0	25,000	191,000	233,000	120,000	583	407	\$212,000	\$1,060,000	\$110.1
1997	910,500	220,000	0	70,000	50,000	0	555,500	5,000	924	932	\$209,420	\$1,047,100	\$229.2
1998	576,500	126,000	0	212,500	238,000	0	0	0	721	1,408	\$573,000	\$2,865,000	\$114.8
1999	574,228	250,000	125,000	0	128,228	0	55,000	16,000	875	1,099	\$503,228	\$2,516,140	\$178.9
2000+	998,000	220,000	140,000	111,000	27,000	0	0	500,000	1,110	1,586	\$995,000	\$4,975,000	\$251.9
TOTAL	12,109,204	2,675,493	2,282,605	844,398	1,524,228	1,418,200	2,088,000	1,276,280	14,342	17,462	\$5,851,883	\$29,261,215	\$2,735.7

Source: BRA, Institutional Planning Department, Oct., 1990.

Prepared by: BRA, Policy Development & Research, M.R.J., 11.05.90., INSTSUM.WK1 (HOWELL)

Table 2: Institutional Research Space and Employment in Boston, 1990 and Projected

Institutions	Existing Research		Proposed Research Space(C)	Additionally Demanded Space(D)	Total Demand For Research:		
	Space	Employment			Space	Employment	Employment
	1990(A)	1990(B)			(E)	Low (F)	High (G)
Longwood Medical Area							
Hospital-Total	1,055,780	3,173	864,493		864,493	887	1,828
Medical School-Total	107,000	329	401,000		401,000	745	848
Non-Profit Res. Inst Total	117,884	275					
Longwood Med. Area Total	1,280,664	3,777	1,265,493		1,265,493	1,631	2,675
West End-Charlestown Medical Area							
Hospital-Total	654,900	1,922	332,000	59,000	391,000	289	827
Non-Profit Res. Inst Total	129,000	301					
West End-Charlestown Total	783,900	2,223	332,000	59,000	391,000	289	827
South Station-Newmarket Medical Area							
Hospital Total	299,000	1,169	338,000	100,000	438,000	389	926
Med.School Total	224,900	692	423,000		423,000	678	894
South Station-Newmarket Total	523,900	1,861	761,000	100,000	861,000	1,067	1,820
City-Wide Other Hospital							
	75,243	232		95,000	95,000	128	201
Hospital Total	2,084,923	6,496	1,534,493	254,000	1,788,493	1,693	3,781
Medical School Total	331,900	1,021	824,000		824,000	1,423	1,742
Non-Profit Res. Inst. Total	246,884	575					
Grand Total	2,663,707	8,092	2,358,493	254,000	2,612,493	3,116	5,523

Notes: (A) Existing space derived from BRA, Medical Industry Survey, 1987.

(B) Existing jobs in hospitals and medical schools reported by hospitals in BRA, Medical Industry Survey, 1987. Where space was known but employment was missing the hospital average of 325 square feet per employee was used. For non-profit research institutes existing employment was reported in BRA, Medical Industry Survey, 1987.

(C) Proposed research space is from institutional plans submitted by the hospitals and medical schools to the BRA.

(D) Additionally demanded space is the space remaining after the hospitals reported their current and future needs in the BRA, Medical Industry Survey, and their current plans in their institutional plans.

(E) This is the sum of data in column (C) and in column (D).

(F) Hospital and medical school low employment was estimated by staffing new and existing space at the optimal level of 473 s. f. per researcher, and subtracting existing employment.

(G) Hospital and medical school high employment was estimated by staffing new space at the optimal 473 s.f. per employee, with no change in staffing rates for existing space.

Sources: BRA, Policy Development & Research Dept, Medical Industry Survey, 1987.

BRA Medical & Educational Institutional Planning Dept., Oct., 1990.

Prepared By: BRA Research Dept., M.R.J. & J.E.A.11.05.90. (S&DJOB2.WK1)

Table 3: Existing, Underway, and Proposed Privately Developed Institutional Space In Boston by Construction Start Year

Project & Address	MEDICAL					CONSTRUCTION PERMANENT		LINKAGE		TOTAL DEV. COST (MILLIONS)
	TOTAL SQ FT	RESEARCH SQ FT	OFFICE SQ FT	ACADEMIC SQ FT	OTHER SQ FT	JOBS	JOBS	JOBS	HOUSING	
Total 1989 Completions										
Charlestown Navy Yard	34,000	0	34,000	0	0	50	159	\$0	\$0	\$6.0
MGH Office Building 62										
Walsh Assoc./BU Med. Sch'l	32,000	0	0	32,000	0	56	68	NA	NA	\$11.4
609 Albany Street										
MASCO Mixed Use Project	339,600	0	59,241	0	280,359	137	334	NA	NA	\$28.0
JMB/Macomber	776,000	776,000	0	0	0	906	1,639	\$400,000	\$2,000,000	\$100.0
Olinsted Plaza										
Total 1990 Starts	1,147,600	776,000	59,241	32,000	280,359	3,140	2,041	\$400,000	\$2,000,000	\$139.4
Charlestown Navy Yard										
Yard's End Building 1	330,000	330,000	0	0	0	660	617	\$200,000	\$1,200,000	\$104.0
Navy Yard Bldgs. 79 & 96	25,000	25,000				32	80	NA	NA	\$6.7
MGH-Diachne										
Navy Yard Bldg. 38	26,000	26,000			0	33	55	NA	NA	\$6.9
Shirners Medical Research										
Total 1991 Starts	381,000	381,000	0	0	0	725	752	\$200,000	\$1,200,000	\$117.6
1992 Start										
South Station Technopolis	578,400	578,400	0	0	0	739	1,220	\$578,400	\$2,313,600	\$153.9
NE Medical Center-Bio Med										
Total Space 1989-2000	2,141,000	1,735,400	93,241	32,000	280,359	4,654	4,172	\$1,178,400	\$5,513,600	\$410.8

Source: BRA, Institutional Planning Dept., October, 1990.

BRA, Policy Development and Research Dept., October, 1990.

Prepared by: BRA, PDR, MRJ, 11.01.90, PRIVINST1.WK1 (HOWELL)

Table 4: Employment in Massachusetts Growth Technology Industries, 1987

S.I.C.:	TOTAL EMPLOYMENT	2831 BIOTECH	384 MEDICAL INSTRUMENTS	7391.7 LABORATORY SERVICES	737 COMPUTER SERVICES	7392 MANAGEMENT SERVICES	80 HEALTH SERVICES	TOTAL OF SELECTED INDUSTRIES
U.S. (1000s)	85,484	24.1	159.2	193.5	618.6	659.5	6,971.8	8,626.7
% OF TOTAL		0.03%	0.19%	0.23%	0.72%	0.77%	8.16%	10.09%
MASSACHUSETTS	2,750,697	890	8,549	13,350	34,859	24,201	259,216	341,065
% OF TOTAL		0.03%	0.31%	0.49%	1.27%	0.88%	9.42%	12.40%
FIVE COUNTY BOSTON METRO	1,924,615	769	6,852	12,668	32,418	21,476	182,798	256,981
% OF TOTAL		0.04%	0.36%	0.66%	1.68%	1.12%	9.50%	13.35%
% OF MASS.	69.97%	86.40%	80.15%	94.89%	93.00%	88.74%	70.52%	75.35%
LOCATION QUOTIENTS:								
MASSACHUSETTS		1.15	1.67	2.14	1.75	1.14	1.16	1.23
BOSTON METRO		1.42	1.91	2.91	2.33	1.45	1.16	1.32
JOB GROWTH, 1987-2000								
MASSACHUSETTS	2,183	2,370	6,756	30,064	12,247	121,451	175,070	
BOSTON METRO	1,886	1,899	6,410	27,958	10,868	85,647	134,669	
ANNUAL GROWTH RATES	10.0%	1.9%	3.2%	4.9%	3.2%	3.0%		

Source: U.S. Dept. Commerce, Census Bureau.

Prepared By: BRA, PDR, J.E.A., 11.05.90, GROTECH8.WK1 (HOWELL)

II. Profile of Boston's Higher Education Institutions

-Richard Henderson

Higher Education is an important part of the Boston economy, in both its role as a major employer and its role in educating the region's future workforce and continuing the education of those presently employed. The Boston area is one of the world's leading centers for higher education, drawing students from around the nation and the world. Over 286,000 students attend colleges in the metropolitan area, 236,000 of them at four year institutions.²

University enrollment. Undergraduate enrollment data for the last 10 years in Boston's largest private universities is presented in Table 1. These universities enroll 119,000 undergrad and grad students, just over half of the 236,000 students attending four year/graduate schools in the region. While freshman enrollments have declined this September at some area colleges, the enrollment decline for all the universities in the table totals well under 1000. The strong national and worldwide reputations of these and other area universities allows them to draw from a large pool of applicants from outside the region. Nearly two-thirds of the past three classes of entering undergraduate students at these universities came from outside Massachusetts.

² Richard Boyer and David Savageau, Places Rated Almanac, 1989.

Table 1

Undergraduate Enrollment, 1983-89, in Boston's Largest Private Universities

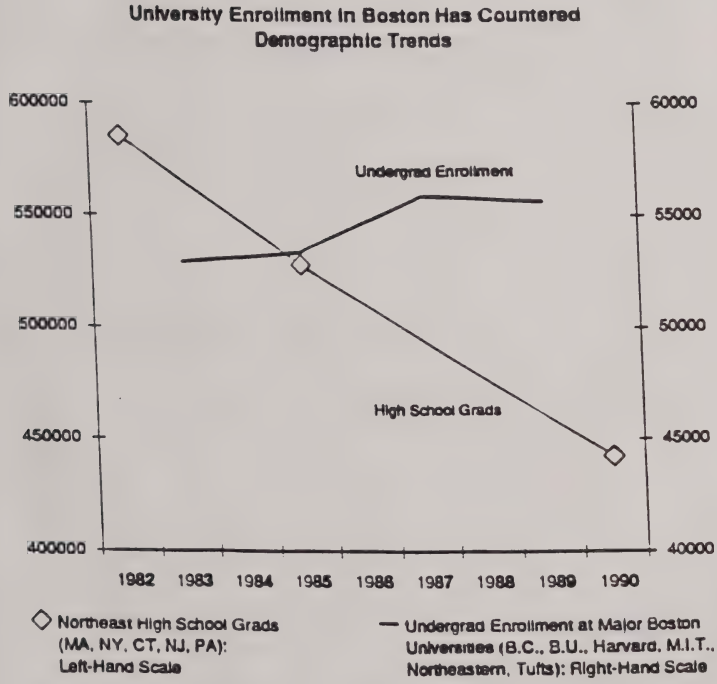
<i>University</i>	<u>1983</u>	<u>1985</u>	<u>1987</u>	<u>1989</u>	Percent of Students From Outside MA*
<i>Boston College</i>					
Total Enrollment	8,928	9,010	10,458	10,326	54
Entering Freshmen	2,175	2,377	2,136	2,118	
<i>Boston University</i>					
Total Enrollment	12,454	12,824	14,499	14,530	78
Entering Freshmen	3,248	3,593	3,813	3,490	
<i>Harvard College</i>					
Total Enrollment	6,537	6,603	6,597	6,587	80
Entering Freshmen	1,609	1,599	1,604	1,605	
<i>Mass. Institute of Technology</i>					
Total Enrollment	4,600	4,391	4,377	4,325	87
Entering Freshmen	1,075	1,061	1,001	933	
<i>Northeastern University</i>					
Total Enrollment	16,000	16,059	15,216	15,149	42
Entering Freshmen	NA	3,975	3,630	3,782	
<i>Tufts University</i>					
Total Enrollment	4,419	4,511	4,750	4,683	71
Entering Freshmen	1,145	1,152	1,352	1,126	
<i>Total Above</i>					
Total Enrollment	52,938	53,398	55,897	55,600	64
Entering Freshmen	NA	13,757	13,536	13,054	
Demographic Trend-	579,000	528,000	494,000	459,000	

Notes: * Approximate percentage based on 1987-1989 estimates for freshmen entrants.

- Trend indicates number of high school graduates in major Northeastern states.

Sources: Individual Universities. Trend from Boston University.

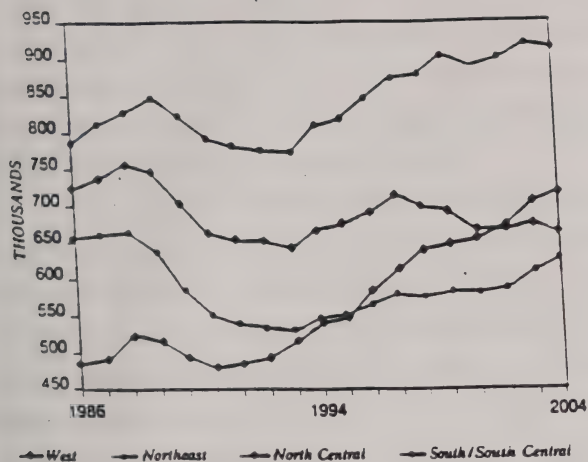
The chart below shows that enrollment has increased even while the number of Northeast high school seniors has decreased significantly. Most of these schools project enrollments will remain steady even though the number of high school graduates is expected to keep declining through 1993. The demographic realities will have a greater effect upon institutions which draw from a local base; however, the decline will taper off after next year, and the second half of the decade will see increases in high school graduates. See the charts on page 11, prepared for the New England Board of Higher Education.³



Sources: Boston University, Barron's college guides

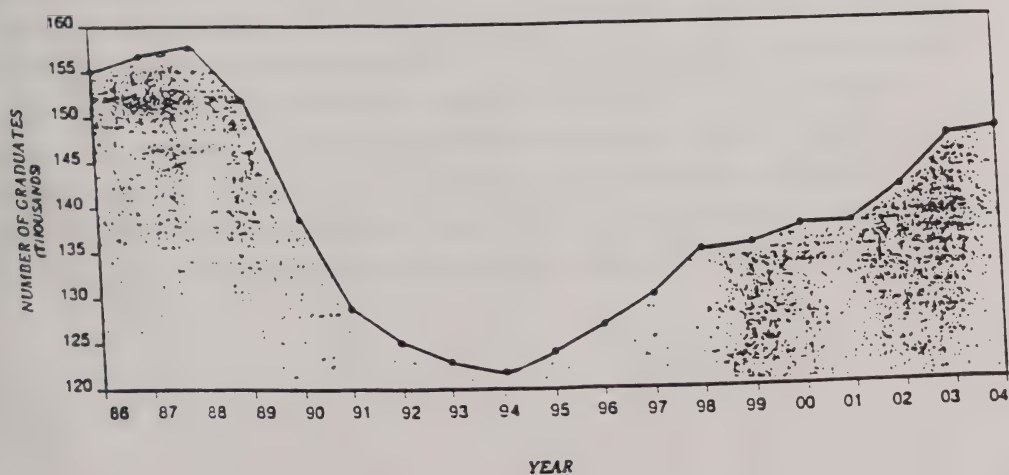
³ Charts taken from "New England Campuses Must Prepare for Drop in High-School Graduates," Connection, Summer 1989.

High School Graduates, 1986-2004 (projected)
By Region



Source: Western Interstate Commission for Higher Education.

Projected Total High School Graduates in New England
1986-2004



Source: Western Interstate Commission for Higher Education.

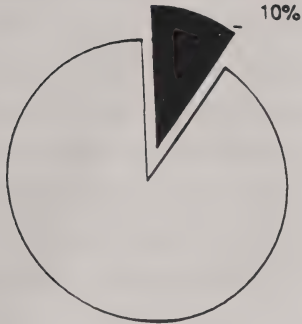
Drawing the Best and Brightest. As the number of high school graduates has fallen, colleges have had to increase their efforts to attract students from further afield. Table 1 noted that almost two-thirds of the undergraduates at Boston's largest private universities come from outside Massachusetts. Many were from foreign countries: Massachusetts had 18,946 foreign students in 1987. This was 5.3 percent of the U.S. total of foreign students; for comparison, Massachusetts had 3.3 percent of all U.S. college students in 1987, and 3.7 percent of all full time students. For New England as a whole in 1987, 10.6 percent of masters degrees and 20.2 percent of doctoral degrees went to foreigners.

This attraction of students from other states and abroad has some positive consequences for the Boston economy. First, schools may employ more people to attract students and funding, by adding staff in Admissions and other departments. Second, schools have developed more attractive curricula, including continuing education programs designed to attract part-time students; the increased quality and availability of these programs allows Boston residents to learn more and increase the quality of Boston's workforce. Third, a significant portion of students from other states or countries decide to stay in Boston after graduation; as area colleges attract more students from outside the region, they bring an increasing number of bright young in-migrants to Boston.

The last phenomenon has an important impact on Boston's economy. The critical role that M.I.T. graduates, for example, have played in the regeneration of the Massachusetts economy over the past few decades has been well documented. A 1989 study by the Bank of Boston estimated that nearly 200,000 people in Massachusetts are employed by companies founded by M.I.T. graduates. Half of the founders started their companies while they were still students or within five years of graduation.⁴ Most of these graduates probably came to Boston from somewhere else, but chose to make their careers here. Almost one third of MIT's current graduate students, for example, come from foreign countries. The charts below and Table 2 indicate that the Boston metro area accounts for only about ten percent of M.I.T.'s incoming classes, but that nearly 24 percent of the last ten graduating classes still live in the Boston area. Some of them may be building the DEC's and Raytheon's of tomorrow.

⁴ Bank of Boston, MIT: Growing Businesses for the Future, 1989

Only One-Tenth of M.I.T. Entrants
are from the Boston Area...



... But a Quarter Stay in Boston
After Graduating

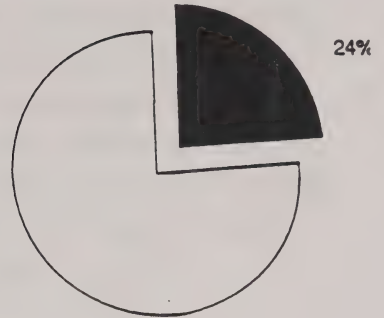


Table 2

Major Areas of Current Residence of 1980-1989 M.I.T Graduates

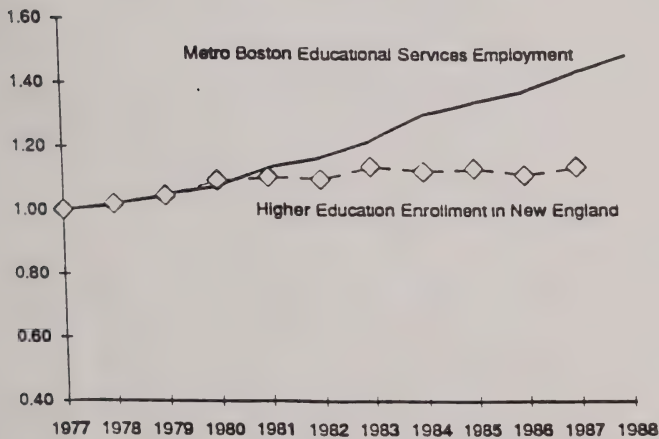
City	Undergraduates	Graduate Schools	Total	Percent of Total Graduates
Boston	2500	2700	5200	24
San Francisco	1100	600	1700	8
New York City	600	400	1000	6
Washington D.C.	400	600	1000	6
Los Angeles	600	400	1000	6
New Jersey	450	350	800	4

Note: Numbers are approximate.

Source: M.I.T.

Employment in Higher Education. Despite negative demographic trends, higher education enrollments held steady or slightly increased throughout New England during the 1980s. Any growth in enrollment was, however, far outpaced by growth in education employment, which in the Boston metro area grew by nearly 50 percent between 1977 and 1988. See the chart on the next page. Most of this growth has been ascribed to administrative rather than faculty positions; it is the latter which are most closely tied to enrollment levels. As competition for students continues to increase in the 1990s, institutions might add further administrative positions in such areas as admissions, marketing and fundraising. After 1995, job opportunities are expected to increase for those seeking faculty positions, because of large numbers of retirements expected from present faculty members. Total number of faculty may change little, but turnover may be at 6 to 8 percent per year.⁵

**Growth of Education Enrollment and Employment
(1977=1)**



Sources: N.E. Board of Higher Education; B.R.A.

⁵ "Goodbye, Mr. Chips," American Demographics, October 1988.

